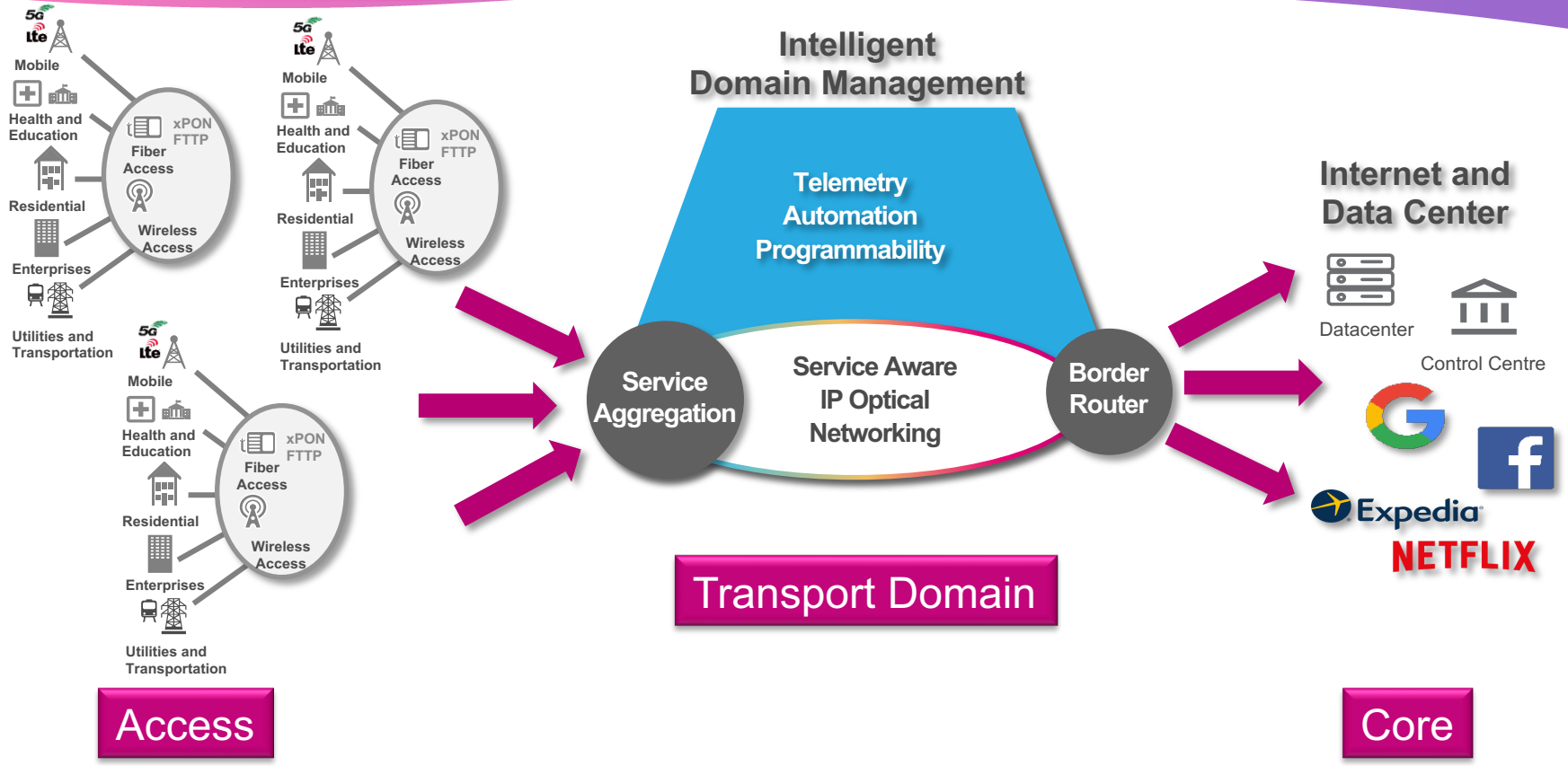
Things to Come
Broadband for the Future

Jack Breeding
Business Unit Leader, US Rural and Tribal Markets

Networks Today and Tomorrow

- Today's Broadband Demands Require Adaptable, Scalable Networks
- Future Apps Are Coming and Will Demand Advanced Transport Technology
- Build for Today, Easily Scale for Tomorrow
- Operate and Manage with Confidence

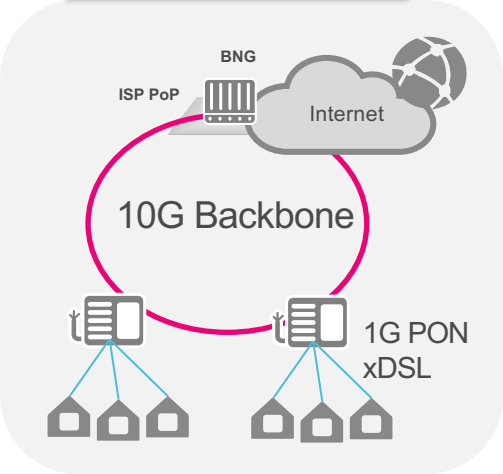
Broadband Architecture Overview



ribbon

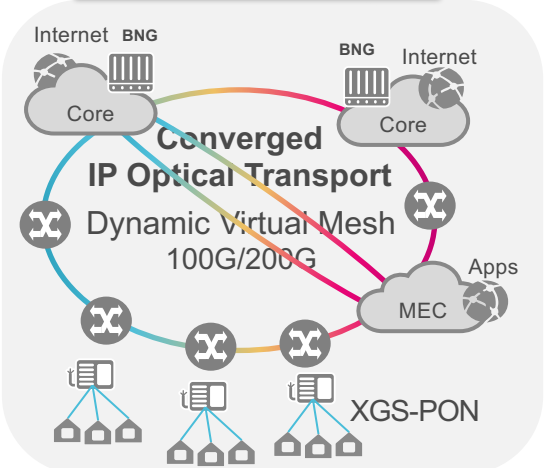
Migration to Complex Architectures

Yesterday



- Mix of xDSL and 1G PON
- Access Unable to Cope with Advanced Services
- Undersized Ring, Difficult and Expensive to Upgrade

Today

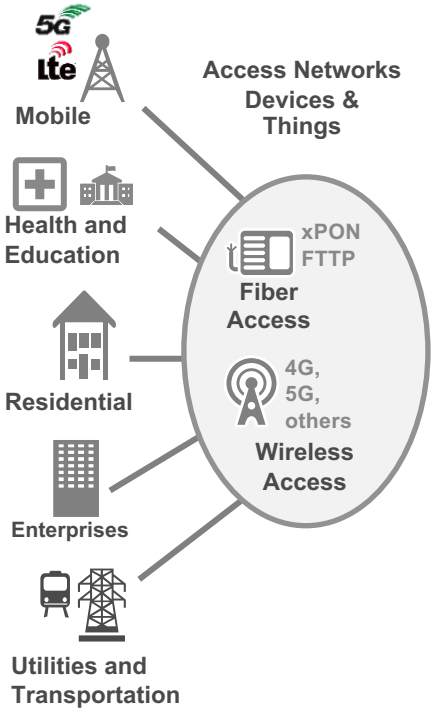


- XGS-PON
- Mesh (Dynamic)
- Higher Capacity 100G, 200G, 400G, 800G
- Transport Backbone Scales Easily To Terabits

ribbon

Why Do I Need Middle Mile Transport?

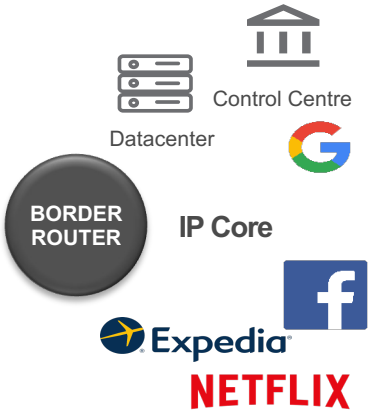
Access Layer



Benefits of the Transport Domain

- Flexible, Scalable
  - Terabits on a Fiber Pair
  - Geographic Reach
- Service Awareness
  - Supports High-Revenue Services
- Administratively Simple to Operate
  - Intuitive, Graphical Point and Click

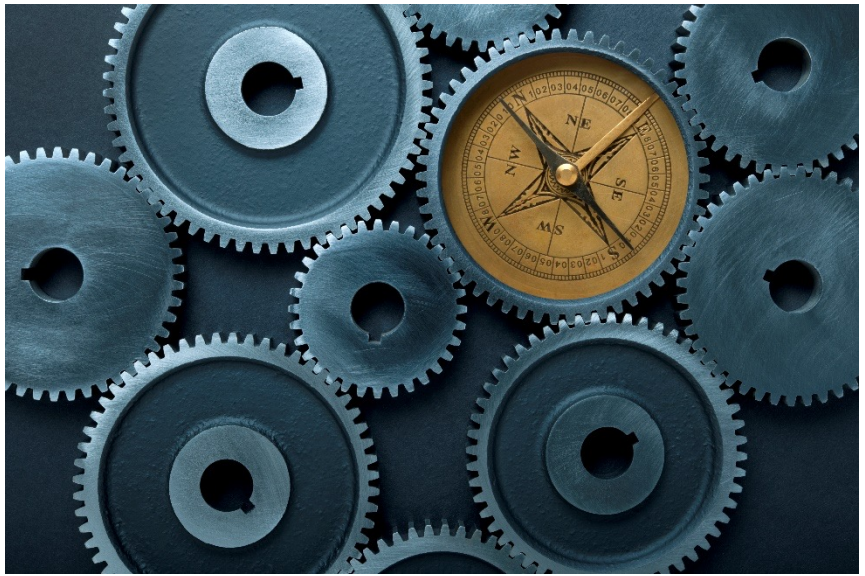
Core Layer



ribbon

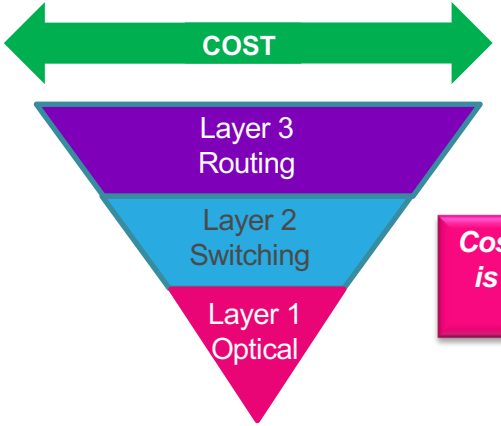
Middle-Mile Transport for Future Demands

- **Scale and Distance**
  - Traffic: How Much and How Far?
- **Traffic Engineering is Critical**
  - Diverse Traffic Requirements Require Advanced Traffic Engineering
- **Operational Simplicity**
  - Single Pane of Glass Management
  - Manage Complexity with Ease
- **Positioned for the Next Opportunity**
  - High Revenue Service Offerings
  - Future Applications

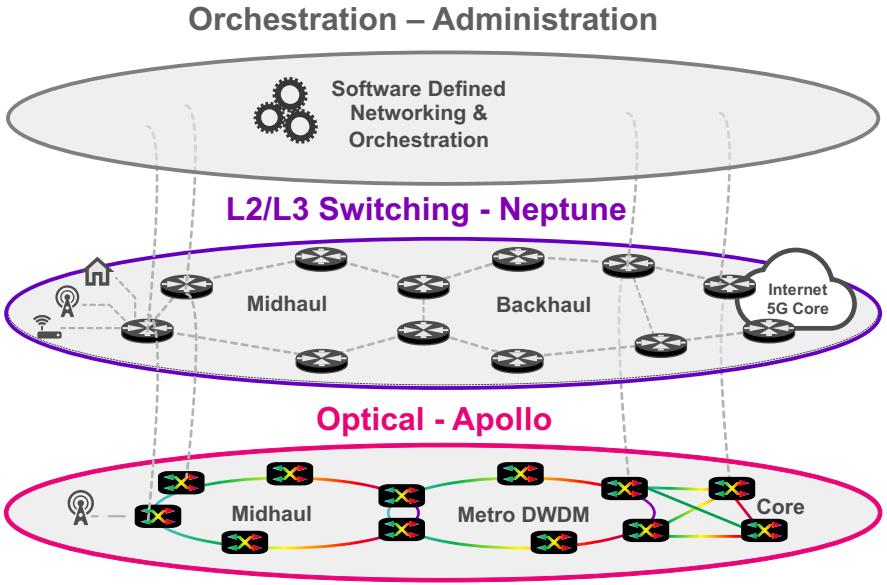


Navigating the Future of Your Network

Scaling the Backbone in 3D



Cost-Efficient Transport is Done at the Lowest Layer Possible



Layer 1 Optical Transport

- Easily Scales as Demand Scales
- Wavelengths are Independent of Bandwidth

Layer 2 Packet

- Basic Traffic Protection
- Simple Traffic Handling, Quality of Service

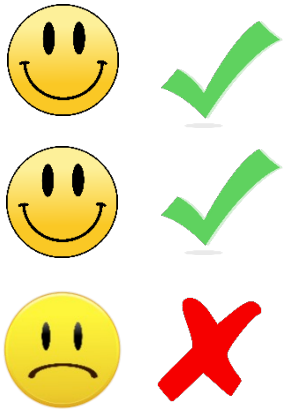
Layer 3 IP/MPLS

- Advanced Service Awareness
- Resilient, Robust Traffic Engineering

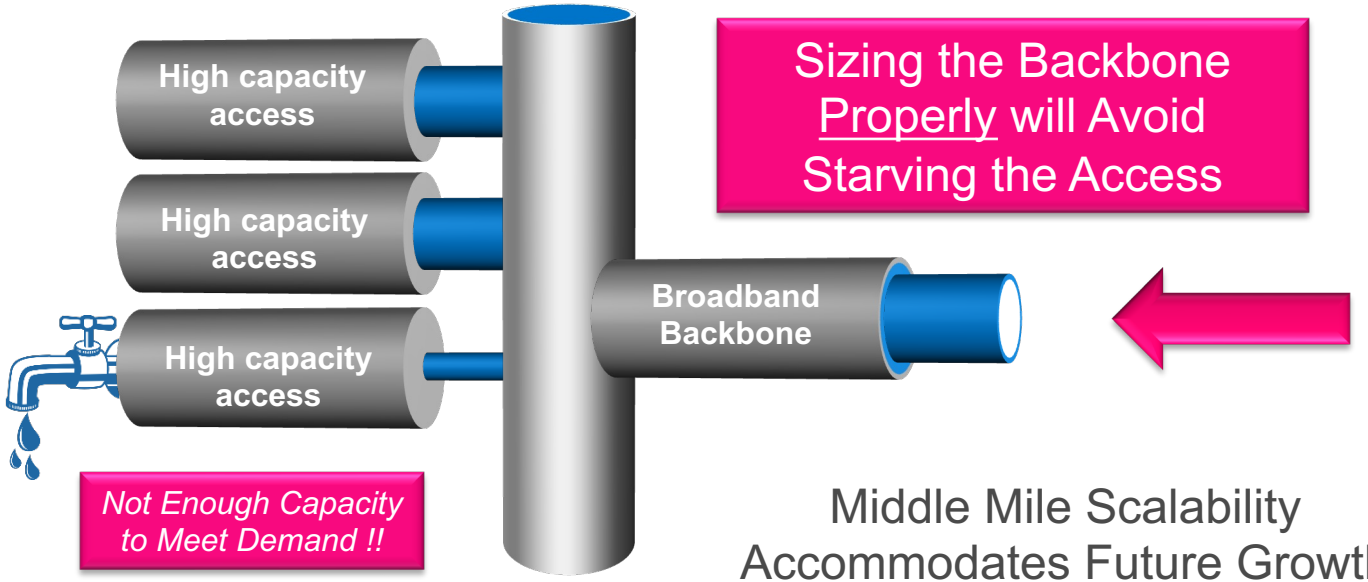
ribbon

Support for the Access Begins at the Backbone

Customer Satisfaction



Edge Aggregation



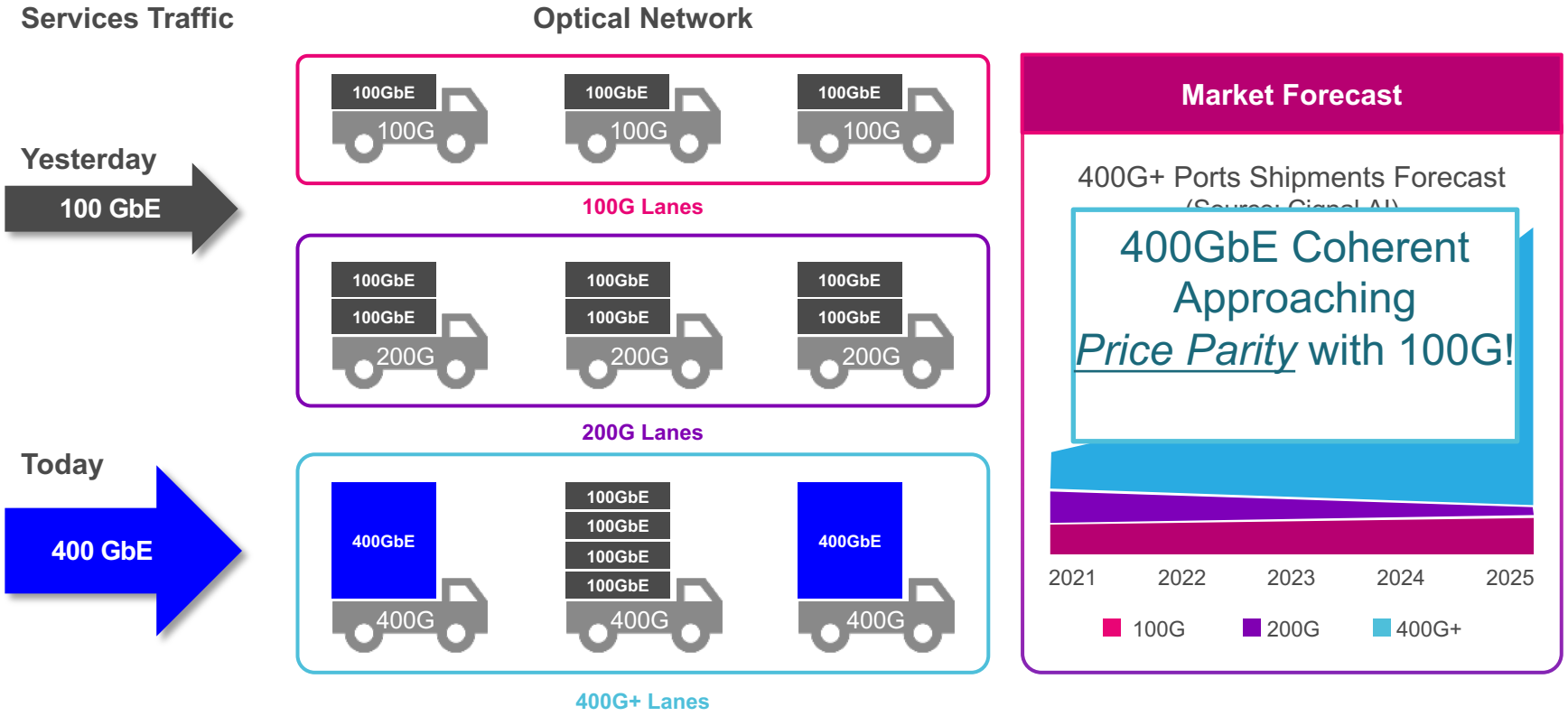
Sizing the Backbone Properly will Avoid Starving the Access

Middle Mile Scalability Accommodates Future Growth

Pay as You Grow

ribbon

Bypassing 200G, the Move is on to 400G



Traffic Engineering is Critical

Internet-based Entertainment

- **High Bandwidth**, “Best Effort”
- Latency: ok
- Minor Packet Loss: ok

Business Connectivity

- **Reliability** is Essential

Distance Learning

- **Security**, Walled Garden

Telehealth

- **Encryption**, Privacy are Paramount

‘Oversubscribing’ is **Essential**

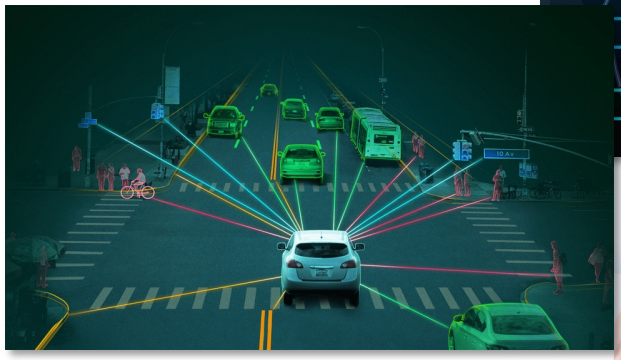
‘Oversubscribing’ is a **Disaster**

Unfettered Access is **a Problem**

Stolen bits are a **Disaster**

The World of Tomorrow, Web 3.0

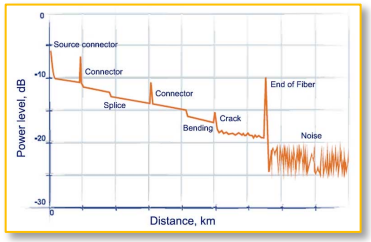
- Decentralization, Edge Computing
  - Banking, Cryptocurrency, Communications, Commerce
  - Low Latency, Security, Reliability
- Autonomous Machines
  - ULL, Security, Reliability
- Immersive Experiences
  - Metaverse, AR, VR, E-Commerce, Gaming
  - Low Latency, Security

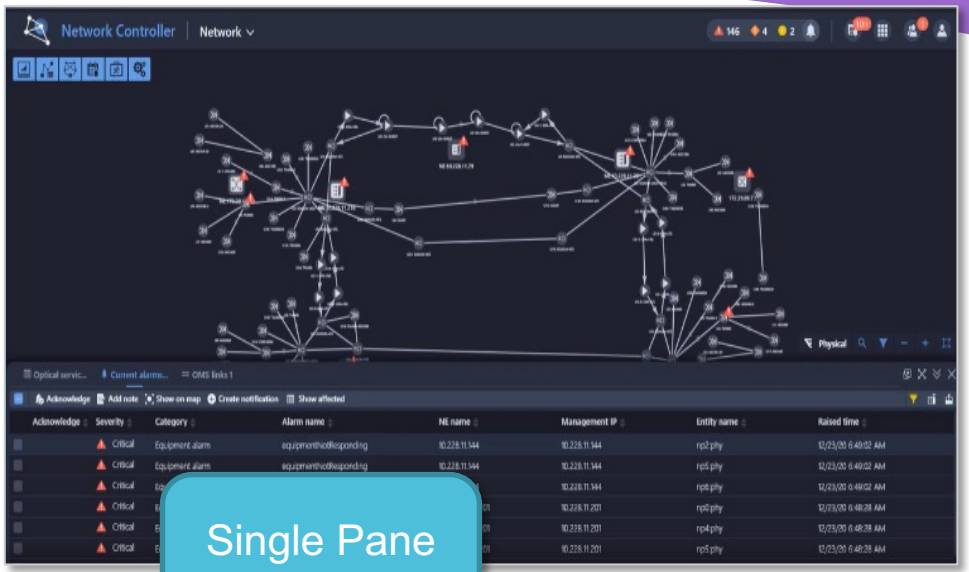


ribbon

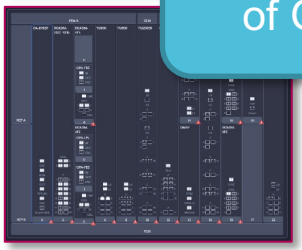
How Do I Manage This?

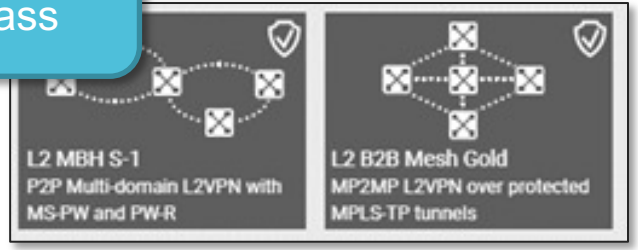
- **Topology** – Simplified Multilayer Topology
- **Optimization** – Maximize CapEx Utilization
- **Provisioning** – Automated, Fast, Accurate
- **Restoration** – Automatic, Reliable
- **Maintenance** - Multilayer Troubleshooting
- **Analysis** - Continuous Telemetry Analysis





Single Pane of Glass



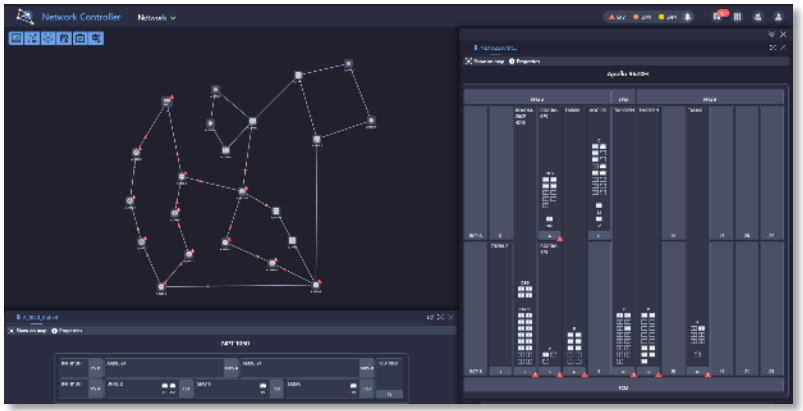


ribbon

Next Generation Management: Doing More with Less

- Multiple Viewing Options
  - Graphical / Tabular
  - Holistic Topology Views
  - Live Shelf Face Diagrams
- Analytical Tools
  - Usage, Fiber/Signal Health
  - Current and Historical Data

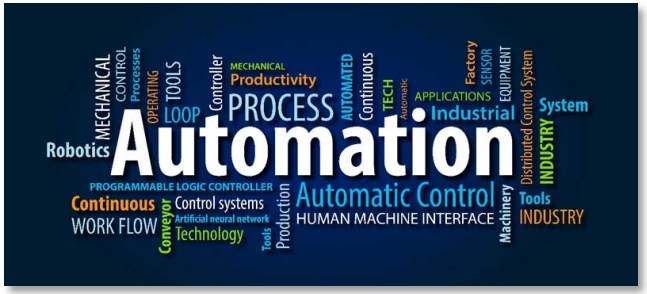
Web-Based,
User Customizable

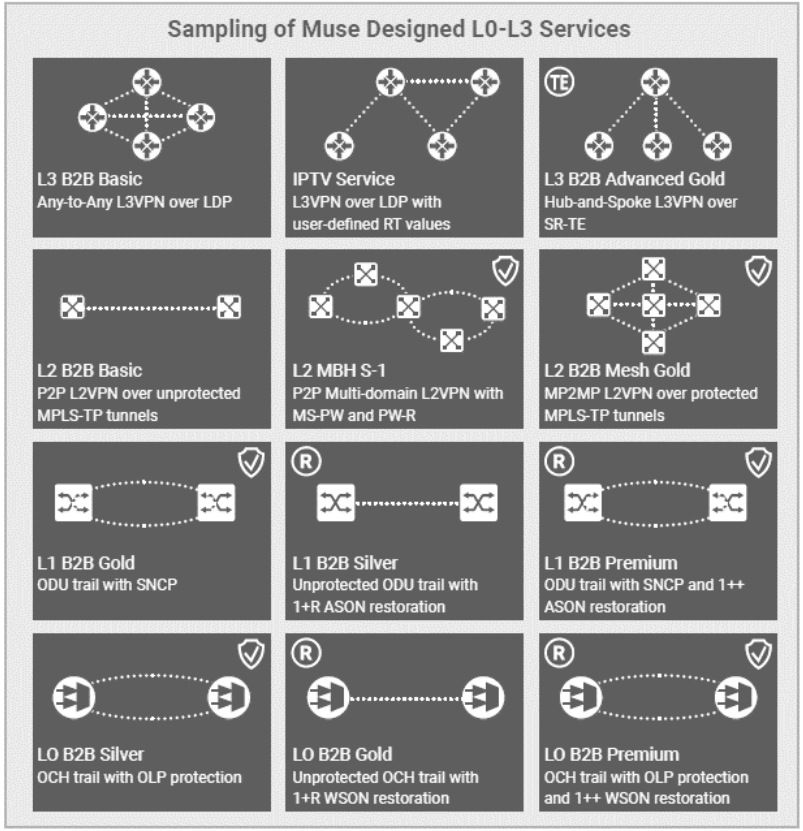


ribbon

Automation: Template-Based Provisioning

- Ready-to-Use Templates for All Services
- Custom Template Design Tool
- Customize Performance and Reliability
- Improve TTM and Accuracy





ribbon

Improving Network Availability: Fiber Health Management

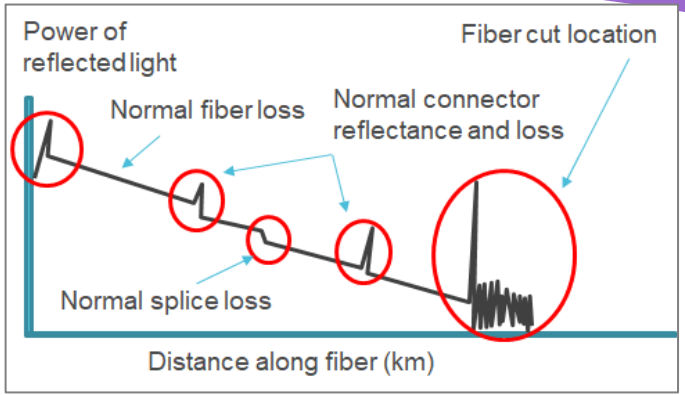
Fiber Outage Typically Leads To:

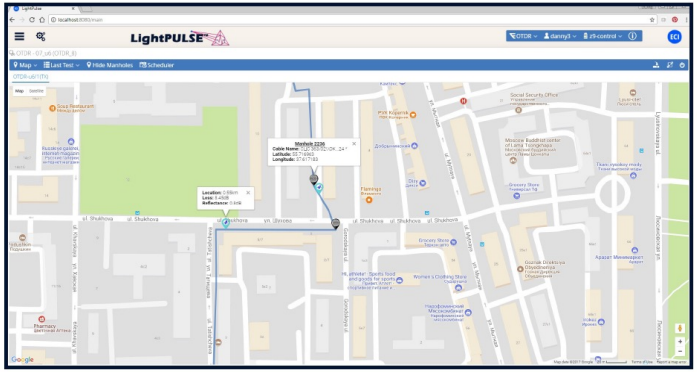
- Truck Roll(s)
- Hand-held OTDRs
- Extended Down Time

In-Service, In-Line
OTDR
Detects Degradation Before Failure

Rapidly Dispatch Repair Crew to Exact Site of Failures

Dramatically Reduce Time-To-Repair





ribbon

The Perfect Storm

Demand

Customer Requirements will Quickly Exceed the Ability to Deliver Without Proper Planning

Technology

Technology is Available Today to Scale and Support Future Demands

Funding

Make Every Dollar Count Extend Your ROI

Scale In 4-Dimensions
Bandwidth, Service Awareness, Intuitive Management, ROI

Contact Information

Jack Breeding
Business Unit Leader

Rural and Tribal Markets
jack.breeding@rbbn.com
(303) 898-4566